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PERSONALITY CHANGES FOLLOWING BRAIN INJURY AS A GRIEF RESPONSE TO THE LOSS OF SENSE OF SELF: PHENOMENOLOGICAL THEMES AS INDICES OF LOCAL LABILITY AND NEUROCOGNITIVE STRUCTURING AS PSYCHOTHERAPY[1,2]

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Summary.—Both theoretical and empirical observations suggest that significant alterations in self-concept should occur following most closed head injuries because of diffuse synaptic modification within the temporofrontal regions; this loss of the sense of self should evoke a grief-like response sequence and should encourage paranormal/religious experiences during the subsequent months to years. The marked consistency between phenomenological experiences and the results of neuropsychological assessments of 56 adults who had sustained brain injuries supported this hypothesis. Subsequent reports by these patients indicated that clinical translation of posttraumatic experiences into rational neurobehavioral terms and interventions tailored for the individual's specific pattern of brain "dysfunction" may facilitate adaptation during the grieving period.

Effective treatment of individuals who have sustained mild to moderate traumatic brain injuries is complicated by the myriad of interactions between the 3-dimensional characteristics of the injury, the pretraumatic personality, the family dynamics, and the alterations in vocational performance (Prigatano, Altmann, & O'Brien, 1990). These factors change in both direction and magnitude during the months and years that follow the injury (e.g., Levin, Eisenberg, & Benton, 1989; Levin, Grafman, & Eisenberg, 1987). Consequently, different expertise, strategies, and tactics may be required during the recuperative processes.

One would expect that the changes in neurocognitive processes that contribute to the sense of self (Persinger, 1992, 1993) should also display a significant temporal dimension. Axonal transport systems, growth cones, proliferation of neuron terminals, compensatory myelination (assuming no autoimmune response; Missaghi, Richards, & Persinger, 1992) and angiogenesis require time frames within the order of months to years. Changes in the vectorial characteristics of covert (thinking) and overt behaviors would be strongly correlated and should be expected because both emerge at the level of synaptic (receptor) organization.

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From this perspective, very diffuse distributions of relatively small amounts of mechanical energy (e.g., mild closed head injury, whiplash, or concussion) throughout brain space could preferentially affect this microstructural organization and evoke comparable catastrophic changes in the sense of self and in the personality. These alterations would be most probable when the temporofrontal lobes are involved because of the powerful association between linguistic processes and the self-concept. The apparent causal relationship between the amount of macroscopic brain injury (defined by computer tomography) and psychological change would be illusionary and secondary to the extent of correlative modification in microstructural organization (i.e., as the amount of visually discernible brain damage increases the likelihood of synaptic/receptor change also increases).

The magnitude of the alterations in the sense of the self and their significant effects upon recovery may be masked during the initial stages of rehabilitation because the focus is upon reinforcing neuromuscular and social skills. Once these overt indicators have reached asymptote (and often after the patient has been released from the rehabilitation unit), neurocognitive phenomena and their behavioral correlates become conspicuous. Although many of these symptoms have been considered components of the "postconcussional syndrome" or the more judgmental term "posttraumatic neurosis," these labels neither eliminate the problems nor explain the neurocognitive etiology.

Traditional attempts to relate phenomenological experiences with brain function have emphasized static radiographic (computerized axial tomography or magnetic resonance imaging) verification of highly localized lesion sites. Such visualization requires gross damage (i.e., extreme neuronal dropout) that may have minimal contribution to the microstructural organization from which behavioral consciousness emerges. The optimal tool for pursuing the neurocognitive association has been thorough standardized neuropsychological assessments and the subsequent inferential problem solving. This statement presumes that (1) thinking, personality, and the phenomenology of the self are subtle, multivariate processes and (2) their characteristics are determined more accurately by aggregates of quantitative measurements rather than by single, qualitative impressions.

If the present perspective is valid, then patients who have sustained mild to moderate brain injuries should display grief-like sequences as a response to the fragmentation of the sense of self; paranormal experiences or religious issues, which are frequently correlates of anxiety concerning the dissolution of the self (Persinger, 1985), should emerge. Patients who asymptote with severe brain injury would be less prone to experience these cognitive phenomena because the synaptic substrates have been eliminated (regressive arborization) or the patient's functional level is less than that of an eight-

to nine-year-old child. Consequently, (1) provision of rational explanations based upon neurocognitive principles that allow the individual to predict and to explain the anomalous experiences and (2) implementation of treatments that accommodate the specific pattern of brain function should facilitate the patient's subjective adaptation.

Method

Patients

A total of 56 (33 men, 23 women) adults (15 to 50 years of age), who had been referred for complete neuropsychological, intellectual, and personality assessments, served as subjects. Thirty-nine (23 men, 16 women) had sustained closed head injuries (CHI; 90% motor vehicle accidents). Patients were assessed one to three years after the injury when all traditional rehabilitation and occupational therapeutic procedures had either terminated or had asymptoted. The reference group ($n = 17$: 10 men, 7 women) had experienced chronic dysfunction for at least 10 years because of spinal, peripheral vascular complications. This group was considered an appropriate comparator because insidious changes should be minimal and the neurobehavioral consequences of the sudden shift in capacity should have been accommodated.

Neuropsychological and Clinical Characteristics

The major regions of dysfunction for the closed head injury group, as defined by a thorough neuropsychological assessment, were the frontal, temporal, temporofrontal, and superior parietal lobes. (CTs had been completed for 21 of the patients who had sustained a head injury and only 11 were considered abnormal; the localization indicators of the neuropsychological assessments were commensurate with the CT interpretation.) Distribution of Reitan-Halstead impairment indices for both groups was mild 30%, moderate 50%, and severe 20%. Except for 7 patients (5 in CHI, 2 in reference group), full scale (Wechsler Adult Intelligence Scale—Revised) intellectual levels were within the average range (85 to 115).

MMPI (Minnesota Multiphasic Personality Inventory) profiles indicated that, as a population, the most elevated ($T > 70$) scales in the CHI group were *F* (frequency), *D* (depression), and *Hy* (hypomania). Scales that infer unusual thinking, social introversion, gender preference, hypochondria, and hysteria were within the average range. Secondary ($60 < T < 70$) elevations were noted on indices of rule-breaking, anxiety, and distrustful irritability. There was no consistent profile for the reference group.

All (31) of the CHI patients who displayed psychometric evidence of left temporal lobe or left and right temporal lobe dysfunction (mild to moderate range) exhibited an increase ($T > 69$) in complex partial epileptic-like signs as defined by either the Personal Philosophy Inventory (Persinger & Makarec, 1987, 1993) or by the phenomenological profile of Roberts, Var-

ney, Hulbert, Paulsen, Richardson, *et al.* (1990). None of the individuals in the reference group displayed these symptoms.

Subjective Reports

All but one of the patients complained that previous medical, paramedical, or rehabilitation personnel had ignored their phenomenological complaints or had attributed them to "psychological" (implying nonphysical or artificial) reasons. The most common concern by the patient and the family involved a change in personality; the most frequent descriptor phrase was the patient "is not the same person" (some spouses no longer wished to be "touched" by the survivors). Marital separation or divorce was reported by about 50% of the patients while major disruption in marital bonding (often secondary to alterations in sexual activity) was evident in more than 90% of the cases. The CHI patients with only right prefrontal dysfunction (10%) attributed their difficulties to other people; the attribution appeared secondary to an unusually enhanced egocentricity.

Recent changes along the four major dimensions of personality, generalized activity (introversion/extroversion), hedonism (avoidance-pain vs approach-pleasantness), arousal (depression vs vigilance), and memory (association vs dissociation, i.e., memory blanks, dreamy states), were reported by all CHI patients but by none of the reference patients. The complaints included unresolved headache, feelings of not being the same person, periodic depression, loss of purpose, absence (or significant) change in family bonding, and episodes of anxiety or panic (i.e., the postconcussional syndrome). About three-quarters (74%) of the CHI patients reported that they had experienced the onset or intensification of paranormal experiences or religious phenomena (most frequently a sensed presence) since the head injury.

Therapeutic Intervention: Basic Procedure and Rationale

If anxiety concerning dissolution of the sense of self is a common process following this type of brain injury, then providing cognitive structure by (1) predicting what the person has experienced, (2) emphasizing the normality of these experiences given the brain area involved, and (3) predicting what will probably be experienced should minimize anxiety and provide relief.

During a 60-min. period each patient was asked to describe the major symptoms and subjective experiences. All symptoms and phenomenology were then explained verbally, with drawings or by models, as normal functions of the brain regions when these are either hyperactive or hypoactive. These detailed explanations were tailored to each person's presenting symptoms.

In addition, specific predictions were made concerning what each patient should have experienced but had not reported. For example, the ex-

perience of "a presence," which was reported by 31 of the 56 patients, had not been discussed previously (even with members of the family). These patients responded quickly and with elaboration to the statement: "About one-third of normal people sometimes experience a presence—like someone standing nearby, along the side—but when the person turns and looks, there's nothing there. Many people who have struck their heads experience these sensations but are reluctant to talk about them because they believe that other people will think they're crazy; however, these are normal experiences."

Examples of specific postsession intervention.—Although there were several neurocognitive, familial, or social issues that concerned the patients with closed head injury, 80% of them were focused upon anxiogenic phenomenology. *Case 1*: This 18-year-old woman had sustained right parietotemporal injury (associated with transient left-sided paresis). About one month after the accident (living at home) she began to awake suddenly between 0300 and 0400 hr. She then experienced intense fear and a sense of a (male) presence along the left side of her visual field. Both her family and the patient attributed the presence to a dead relative; they felt that the woman would soon be "taken."

Vectorial hemisphericity (Persinger, 1993) predicts that the apprehensive sensed presence is associated with the intrusions of the right hemispheric neuroelectrical equivalent of the sense of self into left hemispheric awareness. Consequently, specific activation of the left temporal lobe should disrupt the transient interhemispheric coherence and terminate the intrusions. Sudden lighting of the room was considered inappropriate because of the suppression of nocturnal melatonin and the risk of kindling electrical seizures (Bureau & Persinger, 1992). The patient was instructed to activate a time piece, as soon as she awoke, which then generated a linguistic (voice) statement plus the time.

Case 2: This 38-year-old woman sustained "a concussion." After return to her home, she began to experience alterations in figure/ground relationships and intermittent macroscopia. Return to work in a busy office precipitated periods of "panic." The woman withdrew into her home because there the episodes of panic were reduced. She felt as if she, as a person, was disintegrating. A thorough neuropsychological assessment with specialized testing indicated right temporooccipital lobe anomalies; a screening EEG revealed sharp waves over the left temporooccipital region.

These norm-referenced results in conjunction with the patient's subjective experiences suggested transient electrical lability within the right parahippocampal region (intermittent hyperfunction in neuronal aggregates with persistent hypofunction is not unusual in paraepileptic contexts). When overstimulated by processes that it normally subserves (visuospatial patterns and

the dynamic relationship between elements in space, e.g., a busy office, shopping mall), aberrant vigilance and anxiety resulted. The patient was instructed to (1) minimize any perceptual change within the house, (2) wear a special set of glasses that blocked the peripheral visual field (and hence reduced temporal limbic activation) while in the office, and (3) to listen (via stereo-headphones) to preferred music whenever "anxiety" began.

Case 3: A traumatic injury to the frontal skull of a 33-year-old man was followed by general lower limb weakness that had stabilized. He had been administered unstandardized tests during the final days at a local rehabilitation unit and had been told that he had "severe memory problems." Although he had returned to work, the patient sought help because he was "losing his memory." A neuropsychological assessment indicated no evidence of formal memory deficit within any conventional domain. However, there was evidence of mild weakness for remembering the temporal order of events and a moderate elevation of complex partial epileptic-like signs. Because there was high probability of enhanced suggestibility and the adverse effect of the inaccurate label ("severe memory deficits") he had been given to explain his problems, he was told that our highly specialized procedures had now revealed a hidden factor (this circumvented questions concerning the credibility of the rehabilitation assessment); the difficulty involved organizing temporal order and not the capacity for memory storage. Whenever his work required different serial events, he was asked to record briefly the time and type of each task (hand-held tape recorder) and then to listen to the tape during the last 30 minutes of each work day.

Short-term outcome.—Telephone logs were maintained that registered calls from the clients. Between one and three months later, the results of the complete neuropsychological assessment and the recommendations were shared with the client and the family. Each session was begun with a general question "How have you been doing?" to encourage spontaneous responding. The numbers of patients and family members who reported significant, positive changes were then recorded.

Results

Clinical documentation indicated that 60% of these patients expressed relief when they realized that mystical-religious episodes, intrusive experiences, and concerns about death were normal correlates of disruption of the self-concept; 71% of subjects thought they "were going crazy" and had not discussed these experiences even with family members. A sensed presence was primarily perceived along the left side or visual field for patients whose neuropsychological profiles suggested electrical anomalies in the right parietotemporal lobes and along the right hemispace for patients who displayed left temporoparietal mild indicators. All of the patients with right temporoparietal indicators reported the experiences as terrifying or as unpleasant.

A conspicuous 40% (primarily left hemispheric dysfuncion) of the patients either cried or lacrimated significantly when the neuroanatomical explanation for their experiences was given. The emotional response usually occurred within two specific detailed descriptions of why (via neurofunction) the experiences had occurred. All of the patients reported that no one had believed their experiences were "real."

Short-term Outcome

Within 2 to 4 weeks, 52% of these patients (but 0% of the reference group) called or wrote in appreciation for the "insight"; this measure was employed as an inference of the magnitude of the effects of the neurocognitive labelling upon the patient's behavior (i.e., if a treatment produces a significant positive change, most patients are vocally appreciative).

During the family meeting, just before the formal results of the assessment were presented and discussed, approximately two-thirds of the closed head injury patients had reported, spontaneously, a significant and positive change in their understanding of their subjective experiences. Although the intensity of somatic symptoms, e.g., concentration, distractability, etc., had not altered, they were considered less disruptive. Only two of the members of the reference group reported positive changes.

Sample Cases

For Case 1, the numbers of sudden early morning awakenings and terrifying "sensed presences" decreased within two days after implementation of the procedure. During the subsequent three weeks, the experiences did not reoccur and sleeping was not interrupted. Although the panic episodes were not eliminated for Case 2, the numbers of events were reduced to fewer than one per week; the restricted visual field was considered helpful. Within one week of initiating the tactic, Case 3 was convinced that he did not display a memory deficit and was delighted with his "recovery."

Discussion

Although traditional interpretation of an actuarial presence of brain impairment and the simultaneous elevation of the Depression and Hypomania Scales would require a diagnosis of a brain lesion or organic deterioration, the differential diagnosis for this MMPI profile is the "identity crisis" of adolescence (Lachar, 1974). This interpretation, in context of the stages of (1) continuation of previous behaviors, (2) increased irritability, and (3) depression and withdrawal, suggests a grief response (Rando, 1984) to a significant loss. The grief would be in response to the alteration of the premorbid self-concept and hence would constitute a type of "identity-crisis."

If these changes in personality are correlative to an alteration in self-concept, then the person who has experienced a closed head injury (despite overt presentation) should have a fragile self-concept that can be devastated

easily by the removal of opportunities, freedoms, or activities by which the self is defined. These opportunities can be mundane (e.g., one man, after being told casually by a member of a hospital staff that he had lost his driver's licence, left on a day pass and committed suicide). The fragility would encourage intrusive experiences, such as a "sensed presence," episodes of anxiety concerning self-dissolution (death), and the general experience of imminent psychosis ("going crazy").

These clinical observations and results indicate that structuring the patient's phenomenology and changes in self-concept within the realistic operation of brain function facilitates reduction of anxiety and enhances focus. Although optimally the neurocognitive therapist should be both competent and conversant (i.e., able to easily translate, without trivializing, technical material) with neurofunction, the critical operation appears to be reduction of anxiogenic experiences by attribution to normal, rational sequences of brain function that removes ambiguity and allows predictability. If the explanations accommodate the previous phenomenology, then they should accurately generalize to subsequent experiences that can be categorized or labelled within the rational framework.

As might be expressed by both operant (Skinner, 1957) and rational-emotive (Ellis & Yeager, 1989) theory, the strategy is to employ verbal tacts (labels) that are derived from an organized pattern of behaviors from which falsifiable (empirical) predictions can be generated by the patient through implicit chains (Tucker, 1970) that are then applied to subsequent experiences. This approach contrasts the traditional method of applying labels that are fragmented (i.e., your leg hurts because you cannot sleep) and that indirectly deny the validity ("see a counselor," i.e., it's all in your head) of the experiential reports. If the patient who has experienced a closed head injury is displaying the expected change in self-concept that should accompany microstructural reorganization of the brain (Persinger, 1992), then an "identity crisis" is imminent. Self-tacts (Skinner, 1957) that allow restructuring and stabilization facilitate the adjustment to the "new self-concept."

If the present model is valid, then tacts and autoclitics (Skinner, 1957) that are employed by technical staff during or shortly after the period of posttraumatic amnesia could have long-term consequences upon the patients' expectancy and ultimate adaptation. Animal research (Persinger, Bureau, Kostakos, Peredery, & Falter, 1993) strongly suggests that posttraumatic amnesia is due to subclinical status complex partial seizures that prevent consolidation of declarative memory. In light of the moderate correlation between complex partial epileptic-like symptoms and suggestibility (Ross & Persinger, 1987), inappropriate expectations during the initial rehabilitation could encourage nonadaptable behaviors even after the posttraumatic amnesia had resolved.

A major principle of neurophenomenology is that subjective experiences

are determined by those portions of the brain that are most metabolically active at any given time. By calculating the standardized (*z*) score for each measure with respect to the mean of the norm-referenced scores for all measures (about 100) in the assessment battery, relative elevations or depressions of function for the individual can be inferred with greater precision.

The primary subjective experiences of many of the patients in this study involved themes that are traditionally associated with brain space that *is adjacent* to the ones in which radiographic damage had been verified or for which frank depression in neuropsychological scores had been determined. The existence of a "ring" or torus of neurons with reduced thresholds around damaged or electrically depressed foci may help explain the historical difficulty of matching phenomenological experiences with visible static lesions. Because experiences are based in large part upon activation of neural networks (not their absence), the correlation between behavior and lesion sites may be an artifact of the enhanced neuroelectrical lability that accompany these regions.

Caveat

Post hoc examination of these cases indicated that 11 of the closed head injury patients responded minimally to the procedure. All of them (8 men, 3 women) had experienced significant right frontal or right frontotemporal damage. These individuals, as would be expected traditionally, either denied any changes in the self-concept or perceived others as the source of their change. The positive responses of the patients in this study may have been enhanced because there was (1) selection bias by referral agencies, (2) nonspecific techniques of the clinician, (3) affirmation (relief because someone believed them), or (4) demand characteristics. The changes may have been confounded by the propensity for patients with left hemispheric dysfunction to exhibit catastrophic responses. Long-term outcomes during the subsequent one to five years, when psychiatric complications are most likely to occur, were obviously not assessed.

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